USDA United States Department of Agriculture

Photos: NRCS/Anne Lynn

MARYLAND WILDFLOWER HABITAT ESTABLISHMENT GUIDE

Planting for Pollinators and Beneficial Insects

January 2023

Natural Resources Conservation Service (NRCS) – Maryland

This page is intentionally blank.

Table of Contents

Introduction

The information in this Maryland Wildflower Habitat Establishment Guide is an official part of the Field Office Technical Guide (FOTG) and may be incorporated by reference into conservation practice standards contained in Section IV of the FOTG as well as guidance for financial assistance programs.

This guide is designed for use primarily by field staff who provide technical assistance for conservation planning. It provides information, recommendations, and specifications for the establishment of native plants for wildlife, pollinators, and beneficial insect habitat, with a focus on providing herbaceous pollen and nectar sources for adult pollinators and foliage for their larvae. Woody plants can also provide essential habitat for a wide variety of wildlife and should be considered for inclusion when designing wildflower plantings.

Note: Financial assistance programs may dictate criteria in addition to, or more restrictive than, those specified in this guide. Be sure to refer to specific program guidance for any additional requirements.

Acknowledgements

The content of this guide is based on the New York Wildflower Habitat Establishment Guide, which was developed by the Xerces Society with support from NRCS. Maryland NRCS thanks Kelly Gill and Mace Vaughan for permission to adapt their text and use Xerces photos.

The following individuals collaborated to produce this version for Maryland: Julie Devers, Anne Lynn, and Steve Strano, NRCS, Annapolis, MD; R Jay Ugiansky, NRCS, National Plant Materials Center, Beltsville, MD.

This page is intentionally blank.

SECTION 1 - SITE SELECTION AND PLANTING LOCATION

Preferred sites for wildflower habitat establishment have no to very low pesticide risk, low weed pressure, and conditions that are compatible with establishing the desired plant community and conducting management and maintenance activities. The Maryland conservation practice standard for Wildlife Habitat Planting (420) is a primary practice for establishing wildflower habitat. Where other resource concerns such as erosion are present, the Maryland conservation practice standard for Conservation Cover (327) may be used instead of Wildlife Habitat Planting (420) to provide denser ground cover.

Assess the following site characteristics and select locations where the desired plant community can be successfully established, maintained, and protected from pesticides and other harmful disturbances.

Site Conditions

Pesticide Risk. Habitat plantings immediately adjacent to lands frequently treated with pesticides (e.g., cropland) can adversely affect pollinators and beneficial insects. Habitat must be protected from insecticide, fungicide, and herbicide drift from pesticides applied on-site and off-site, including pesticides approved for use on organic farms. Preference should be given to establishing new habitat in areas with no to very low risk of pesticide drift. Note: Herbicides may be used for site preparation or targeted weed control. Avoid long-residual herbicides that can affect subsequent plant establishment. For sites that are enrolled in a financial assistance program, refer to program requirements concerning the use of pesticides and weed control.

Existing Cover and Weed Pressure. Prioritize selection of sites with no or minimal existing cover and low weed pressure. Undesired plant cover, especially perennial weeds and persistent species such as tall fescue, must be less than 5% of site cover before planting the desired species. Sites with dense cover and/or high weed pressure usually require multiple years of weed control. The Maryland conservation practice standard for Herbaceous Weed Treatment (315) can be used as a supporting practice with Wildlife Habitat Planting (420) or Conservation Cover (327) when multiple treatments are required to control existing vegetation, or where site preparation must occur in the year(s) prior to planting.

Soil Conditions. Soil moisture characteristics are an important consideration for selection of any planting. Some plants are better adapted to dry sites while others are found more frequently in wet sites. Many pollinator plants tolerate a range of soil types. Use the *Maryland Conservation Planting Guide* (located in the Field Office Technical Guide (FOTG) Section II-F) to select species that match the moisture, drainage, and other conditions of the site. Avoid areas with rocky ground, fill, restrictive layers, or lack of topsoil. Soil amendments are usually not required for wildflower plantings. On sites with low pH, apply lime to raise pH to 5.5. Do not apply fertilizer -- it is not necessary for native wildflowers and can encourage weed growth.

Slope. Avoid steep slopes and highly erodible soils, especially if tillage is needed for site preparation. For the revegetation of highly erodible sites, use the Maryland conservation practice standard for Critical Area Planting (342) or other suitable practices.

Sun - Shade. Most native wildflowers grow best in full sun (6 or more hours of light per day, or 4 hours of midday sun), but many can tolerate part shade (3 to 6 hours of light per day). If light conditions are not full sun, identify at least 3 shade-tolerant species that can be used on the site for each bloom period (spring, summer, fall). Refer to the *Maryland Conservation Planting Guide*, Section 2, Table 2.4 (“Traits” column) to identify shade-tolerant species. Avoid planting on sites with full shade (e.g., closed canopy conditions).

Equipment Access

Locate new habitat in areas accessible to equipment for site preparation, planting, and maintenance. Avoid sites with excessively wet conditions or seasonal or frequent flooding, as these conditions can make successful plant establishment and habitat management very difficult.

Irrigation

Irrigation is generally not needed for plantings established from seed. When feasible, irrigation should be used to enhance survival on sites planted with herbaceous plugs or containerized stock.

Planting Size and Configuration

Larger or connected habitat areas are ideal for supporting abundant and diverse populations of pollinators and beneficial insects, but habitat can be created in smaller patches or strips and still provide benefits. Consider expanding or adding to existing habitat.

Clumps of one species will attract more pollinators than individual plants scattered throughout a habitat area. If interplanting herbaceous wildflowers with shrubs or trees, intersperse the wildflowers in clumps of like species in between the woody plants.

Refer to the *Maryland Wildlife Habitat Planning Guide,* Section 4, Native Pollinators, for minimum width and areal requirements for pollinator habitat.
Note: Some financial assistance programs may have additional minimum requirements.

Figure 1.1. A diverse wildflower mix planted along an existing forest edge provides high-quality forage and enhances vertical layering of habitats. *Photo: Xerces Society/Kelly Gill.*

SECTION 2 - REQUIREMENTS FOR PLANT MATERIALS

The Maryland conservation practice standard for Wildlife Habitat Planting (420) can be used to establish native herbaceous plants (forbs, legumes, grasses) and shrubs. Where erosion is a concern, use the Maryland conservation practice standard for Conservation Cover (327) to establish herbaceous plantings. For establishing trees and/or shrubs, use the Maryland conservation practice standard for Tree-Shrub Establishment (612). Refer to the *Maryland Conservation Planting Guide*, Section 2 for recommended pollinator mixes, and Section 4 for recommended tree and shrub species for pollinator habitat. Plant selection criteria and plant materials requirements for pollinator habitat are described below.

Species Selection

Native Species. Focus plant selection on native perennials that provide pollen- and nectar-rich forage for pollinators and beneficial insects, and larval food plants for butterflies and moths. For herbaceous plantings, non-competitive native bunch grasses (e.g., broomsedge, little bluestem, purpletop) may be included at a low rate -- less than 25% of the mix based on pure live seed (PLS) per square foot. Native trees and shrubs are essential components of habitat needed to support a wide variety of wildlife and should be considered for inclusion when designing wildflower plantings.

Bloom Requirements. Select individual species that, in combination, provide consistent and adequate floral resources throughout the growing season. Herbaceous plantings must include a minimum of 3 species from each bloom period (spring, summer, fall). A more diverse mix is encouraged. If woody species will be planted, consider including species that bloom early in the spring (e.g., spicebush, black or red chokeberry, Virginia sweetspire, black locust, black cherry, tulip poplar) when other nectar and pollen sources are not widely available.

Specialized Monarch Habitat. When monarch habitat is the primary purpose, criteria for the target plant community requires at least 1.5% native milkweeds (the larval food source) and at least 60% monarch nectar plants that bloom when adult monarchs are present in the local area (breeding and migration). Refer to the *Maryland Conservation Planting Guide*, Section 2, for recommended seed mixes for monarchs. A list of plant species that provide larval food sources and/or nectar for monarchs can be found in *Maryland Native Larval Host and Nectar Plants for Monarchs* in Section II-F of the FOTG.

Non-Native Plants. Non-native plants are not recommended for natural areas or unique ecoregions, and their use may be restricted if the planting will be established with a financial assistance program. Contact the NRCS State Biologist before modifying an approved native mix with non-native species.

Alternate Pest or Disease Hosts. In most cases, native wildflowers used in pollinator habitat are not alternate hosts for crop pests or diseases. Check for host plant potential when specific pests or diseases are a concern.

Seed

Pure Live Seed (PLS). Seed must meet certification standards and be labeled with purity, germination, weed seed, and noxious weed seed contents. Do not use unlabeled/untagged seed. When seed is produced by the grower, there will be viable and nonviable seed of the desired species, plus other crop seed, weed seed, and/or inert materials (chaff, stems, and other plant parts) in a seed lot. This is “bulk seed.” Many seed companies advertise and sell wildflower mixes in bulk pounds per acre. NRCS seeding rates for wildflower mixes are in pure live seed (PLS) pounds per acre or PLS seeds per square foot. PLS seeding rates are based on the percentage of viable seed of the desired species that will germinate and produce a seedling.

Make sure to specify PLS when ordering seed. Do not purchase as bulk seed or use economy mixes. Bulk seed for wildflower mixes tends to contain a high percentage of inert materials, so the weight of viable, desirable seed

Figure 2.1. Wildflower seed varies in size, shape, and texture, as shown above. Bulk seed can contain significant amounts of inert materials (chaff, stems, and other plant parts). ***Photo: Xerces Society/Kelly Gill.***

may be significantly less than the total weight in a bag (e.g., 10 pounds of a bulk mix may be only 50% PLS, thus only 5 pounds of the desired species). Stock wildflower mixes may be less expensive on per weight basis but will not provide all the benefits of a mix specified in the *Maryland Conservation Planting Guide*.

Seed Mixes and Seeding Rates. Seed mixes and seeding rates must meet the applicable Maryland NRCS practice standards and Implementation Requirements. Species substitutions or modifications of approved seed mixes, including species substitutions or modifications recommended by seed companies, must be approved by NRCS prior to planting. The minimum seeding rate is PLS 30 seeds per square foot (seeds/SF) for a well-prepared seedbed. The standard mixes for herbaceous pollinator plantings in Maryland are Mixes 15, 16, and 17 found in Table 2.2 of the *Maryland Conservation Planting Guide*. The components of these mixes may need to be adjusted based on commercial availability, seed cost, or other factors. Forb substitutions can be specified using the rate provided in the "Forb Mix – PLS Lbs/Ac" column of Table 2.4 of the *Maryland Conservation Planting Guide*.

The rates provided are based on a pollinator mix containing 3 species of native grass accounting for 10% of the mix combined, and 10 species of forbs accounting for 90% of the mix combined, with an overall PLS seeding rate of 30 seeds/SF. Substitutions at the listed rates will provide the minimum required PLS 30 seeds/SF when the mix contains 10 forb species. In a mix with more than 10 forb species, the seeding rate in seeds/SF will be slightly higher than the minimum requirement. Substitutions may also be made with the assistance of the Maryland Pollinator Mix Tool (to use the Tool, contact the State Biologist). Appropriate grass species may be substituted at the "Forb Mix – PLS Lbs/Ac" rate listed in Table 2.3 of the *Maryland Conservation Planting Guide*.

When interseeding into an area with existing cover that has been significantly set back or controlled, the minimum PLS seeding rate is 40 seeds/SF. The existing cover should be suitable as part of a pollinator mix, typically consisting of native grasses that lack a diverse forb component. Mix 8d of Table 2.2 of the *Maryland Conservation Planting Guide* is a standard mix for interseeding. Species in this mix have been selected based on their ability to establish in existing, but set back, native grass plantings.

Order Seed Packaged Separately. Wildflower seeds range in size and texture. Using equipment that can accommodate different seed types will result in better distribution across the planting area. When seeding will be implemented with a native seed drill that has boxes for different size seeds, it may be helpful to request that the seed be provided separately by species. This will allow for use of different seed boxes and better seeder calibration.

Live Plants (Plugs, Containers, Bare-Root Seedlings)

Plugs and container plants are more expensive to purchase and require more labor than planting seed but have the advantage of establishing a planting more quickly. Due to the cost of the plants and labor requirements, plugs and containers are best suited for establishing plantings on small sites (e.g., 1 acre or less).

Purchase plant materials from local or regional sources that are adapted for the Mid-Atlantic Region and are pesticide-free (e.g., no neonicotinoids). Straight native species are preferred over ornamental cultivars that may not be as beneficial to pollinators.

Rooted plant plugs (or "tubelings" -- rooted plants in a tube of soil) are typically sold in 50-cell flats. A reasonable size for plugs is 2'' deep x 2'' diameter. Larger, more robust plant plugs or tubelings are preferred if available and economically feasible.

Bare-root seedlings are often used for trees and shrubs because they are less expensive and easier to install than container plants. They are usually purchased and kept in a dormant condition for a spring planting.

SECTION 3 - SITE PREPARATION

Proper site preparation is the most important and often inadequately addressed component of establishing a wildflower planting. It is a process that may require more than one season to reduce competition from weeds or other undesirable plants, and to deplete the weed seed bank prior to planting. For ease of establishing wildflower habitat, prioritize areas with no or minimal existing vegetation and low weed pressure.

Sites with existing vegetation and/or high weed pressure usually require significantly more time and effort to eliminate competing vegetation before planting wildflower habitat. The type and density of existing vegetation will determine how much pre-planting control is needed. It's important to allow adequate time to complete this process. If significant quantities of aggressive weeds or persistent plants (e.g., mare's tail, cool-season grasses) are present, a year or two may be needed to control them before planting, especially for large areas. Noxious weeds — johnsongrass, shattercane, bull thistle, Canada thistle, musk thistle, plumeless thistle, Palmer amaranth, and common (or tall) waterhemp — must be controlled as required by Maryland state law.

On sites that require multiple treatments to control existing vegetation or where site preparation must occur in the year(s) prior to planting, use supporting practices such as Maryland conservation standards for Brush Management (314), Cover Crop (340), and/or Herbaceous Weed Treatment (315). Weed pressure and/or competing vegetation must be less than 5% cover when site is planted to pollinator habitat.

For more information about controlling specific weeds, contact the local Maryland Extension office or county weed control specialist.

Considerations for Site Preparation

Consider the following when selecting a site preparation method and timelines:

Sites without Existing Vegetation. If wildflowers will be planted into a clean, relatively weed-free area (such as cropland that was planted during the previous growing season), then competition from existing vegetation should not be a major concern. Previously cropped lands that were cultivated for several years are generally lower in weed pressure than other areas. If possible, establish wildflowers on sites with a history of excellent weed control. Consider using a cover crop or nurse crop (see the Cover Crops section) for erosion control and/or to reduce future weed competition.

Figure 3.1. Cropland site -- weed species covering <5% of proposed planting area. ***Photo: Xerces Society/Kelly Gill.***

Consider any noxious or aggressive weeds on the site that might have been suppressed (but not killed) with previous herbicide applications. If live rootstocks are present, these weeds may be very difficult to kill in a new planting without destroying the desirable plants. If a weed problem is suspected or if the site's weed history is unknown, it may be prudent to wait one full growing season to see what comes up. Use an appropriate herbicide or non-herbicidal method to treat weeds if they occur, and plant a full season cover or smother crop. Then plant the wildflowers in the fall (as a dormant planting) or the following spring. Spring plantings of wildflowers may be conducted until early summer if sufficient moisture is available.

Sites with Existing Vegetation. These are sites with year-round cover of introduced grasses (e.g., tall fescue) and/or persistent forbs (e.g., Canada thistle) that have been actively growing and producing seed. These conditions typically occur in fields that have been left in a weedy condition following cropping, and in low maintenance hayland, pasture, or idle areas. Sites with these conditions will require significantly more time and effort to eliminate competing vegetation.

Assess existing plant pressure and weed species on the site when developing a site preparation plan. Identify the types of plants present (e.g., annual or perennial, grass or broadleaf, dominant species) and how they reproduce (e.g., by seed or vegetatively). Match site preparation methods and timing to be most effective against prevalent plants on site. Site preparation should prioritize removal of persistent, perennial plants.

Figure 3.2. Existing vegetation, high weed pressure -- dense vegetation dominated by persistent plants covering 50% or more of the proposed planting area. *Photo: Xerces Society/ Kelly Gill.*

Figure 3.3. Existing vegetation, moderate weed pressure -- persistent plants covering 10-50% of proposed planting area. *Photo: Xerces Society/Kelly Gill.*

Minimizing Soil Disturbance. Non-tillage weed removal practices are less likely to release dormant weed seed or spread live rootstocks and are preferred over tillage. If tillage is necessary, use shallow cultivation and avoid excessive and aggressive ground disturbance that may expose additional weed seed and distribute rootstocks. Deep tillage is not recommended unless needed to break up dense vegetation (e.g., pasture, hay, idle areas).

Avoid using tillage or other ground-disturbing practices on steep slopes and highly erodible soils where erosion is a concern. Instead, use other site preparation methods such as herbicide, solarization/tarping, or a smother crop to suppress weeds prior to planting seed with a no-till drill or hand planting live plants.

Common Equipment Needed. Mower or bush-hog, cultivation equipment (e.g., disk, harrow, sweep cultivator), cultipacker or weighted barrel roller, raking implements, spray equipment, and if using cover/smother crops, seeding and termination equipment.

Site Preparation Methods

The following sections describe several site preparation methods that can be used alone or in combination before planting wildflowers:

- Non-Persistent Herbicides
- Solarization and Tarping
- Tillage
- Cover Crops
- Summer Smother Crop (Buckwheat)
- Summer Smother Crop (Teff)

Table 3.1 provides an overview of these site preparation methods.

Table 3.1. Summary of conditions under which different site preparation methods may be used. See following sections of this guide for additional details and recommendations for timing of activities.

Conditions	Suitability for Primary Site Preparation			Suitability for Secondary Site Preparation	
	Non-Persistent Herbicides	Solarization and Tarping	Tillage	Cover Crops	Summer Smother Crop: Buckwheat or Teff
No or minimal existing vegetation -- *recently cropped, bare ground, < 10% vegetated, and/or minimal to low weed pressure*	Usually not needed unless there is a known or suspected weed control problem, and permanent planting will be delayed. See below for treating existing vegetation.	Usually not needed unless there is a known or suspected weed control problem, and permanent planting will be delayed. See below for treating existing vegetation.	Usually not needed unless the soil is highly compacted. See below for treating existing vegetation.	Can provide temporary cool- or warm-season cover (erosion control and/or weed control) before a permanent planting in spring or fall.	Can provide temporary warm-season weed control before a permanent planting in fall. Teff is more drought/heat tolerant, but buckwheat provides abundant flowers. See end note below for buckwheat.
Existing vegetation -- *pasture/hay, perennial grasses (e.g., tall fescue) and/or moderate to high weed pressure*	Very effective for killing vegetation. Must follow label directions. Some weeds are herbicide resistant. Extremely vigorous turf or weeds may require multiple treatments.	Effective for killing growing plants and reducing the viability of weed seeds. Less effective than herbicides for killing deeply rooted weeds. Needs full sun. Best suited for small sites on flat or gently rolling land; south-facing slopes may also be suitable.	Use tillage to break up dense cover, such as sod, and for final preparation of seedbed for planting. Usually less effective than herbicides or tarping/solarization for weed control. Avoid using tillage on steep slopes and highly erodible soils.	Can be used after treating existing vegetation to provide temporary cool- or warm-season cover (erosion control and/or weed control) before a permanent planting in spring or fall.	Can be used after treating existing vegetation to provide temporary warm-season weed control before a permanent planting in fall. Teff is more drought/heat tolerant, but buckwheat provides abundant flowers. See end note below for buckwheat.
Existing vegetation -- *pasture/hay, perennial grasses (e.g., tall fescue) and/or moderate to high weed pressure on* ***organic*** *farms*	Use only if the herbicide is approved for organic operations. May require multiple treatments over several years. Best suited for controlling annual broadleaf weeds. Generally not effective on grasses.	Same as above.	Same as above.	Same as above.	Same as above.
Existing vegetation -- *sites dominated by invasive, noxious, or prohibited species*	Very effective for killing vegetation. Must follow label directions. Some weeds are herbicide resistant. Extremely vigorous weeds may require multiple treatments over several years.	Same as above. May require treatments over several years. Herbicide treatment may also be needed for deeply rooted weeds.	Not recommended. Tillage tends to expose weed seeds and spread rootstocks.	Same as above. Assess effectiveness of weed control before permanent planting.	Same as above. Assess effectiveness of weed control before permanent planting.

TABLE 3.1 NOTES:

- Mowing can be used in combination with above methods as described in the sections that follow.
- Buckwheat produces abundant flowers that are attractive to pollinators, especially bees. However, it is poorly tolerant of drought and high temperatures. It is better suited for planting in Western Maryland than in other regions of the state.
- For additional details on site preparation, including organic methods not included in this guide, refer to *Organic Site Preparation for Wildflower Establishment* (see Xerces Society, References section).

Non-Persistent Herbicides

***Where to Use*.** Sites with low risk of offsite herbicide runoff/drift and are accessible to spray equipment. Chemical (non-organic) herbicides can be very effective on sites dominated by invasive, noxious, or prohibited plant species, pervasive weeds, and/or persistent perennial vegetation that needs to be removed or controlled. Extremely vigorous weeds may require multiple treatments over several years, and some weeds are herbicide resistant.

Organic herbicides are available, but are generally less effective than conventional chemicals, especially for treating persistent broadleaf weeds and grasses. Organic products may be suitable for controlling broadleaf annuals prior to planting wildflowers.

Regulations. Chemical herbicide treatments must comply with Maryland Pesticide Applicator requirements and be applied in accordance with label instructions as required by law. Choice of organic-approved herbicide must be acceptable to the Organic Materials Review Institute (OMRI) for organic operations or, if not, used outside of certified ground and approved by an organic certifier.

Caution. Wet climatic conditions may be prohibitive to equipment access. Adjust the schedule of activities listed below to avoid wet conditions or periods of prolonged drought. Carryover from herbicide treatments (recently applied or from prior years) can pose a threat to new plantings. Seedlings are particularly sensitive to herbicide carryover. The persistence of herbicides is directly affected by factors such as soil pH and moisture. To assess risks before planting, read the herbicide label or contact the manufacturer for specific information on persistence.

Additional Information. Contact the University of Maryland Extension or county weed control specialist for specific herbicide recommendations. For information on organic herbicides and other organic site preparation techniques, refer to *Organic Site Preparation for Wildflower Establishment* (Xerces Society, 2018, References section).

Figure 3.4. This site was prepared with a single herbicide treatment, leaving significant stubble and persistent weedy grasses. It is *not ready* for planting. *Photo: Xerces Society/ Brianna Borders.*

Figure 3.5. This site was treated for an entire growing season whenever new weeds appeared. The stubble has been removed and it is ready for planting. Neither site has been cultivated. *Photos: Xerces Society/ Brianna Borders.*

Instructions

1. ***Early Fall or Spring.*** Mow existing vegetation as short as possible to clear the site. Rake off clippings and remove thatch to expose new weed growth. Monitor regrowth. Apply non-selective, non-persistent herbicide (e.g., glyphosate) to weeds at the recommended plant height per label instructions.

   For extremely vigorous turf or weeds, plan to make one application of herbicide in early fall of the previous year, followed by another application the following spring. Or if the first herbicide application is made in the spring, plan to make a second application a few weeks before planting, depending on label directions and site conditions.

2. ***Spring Through Late Summer.*** Repeat herbicide treatment throughout entire season as needed. It is important to continuously monitor weed growth for proper timing of herbicide application.

   Mow or string trim any herbicide resistant weeds to prevent flowering and weed seed dispersal. Assess the need for a targeted herbicide treatment for resistant plants.

   Shallow cultivation with light implements set no deeper than 2 inches can be used as an alternative to one or more herbicide treatments where erosion is not concern. Repeat shallow cultivation each time regrowth reaches 4-6 inches tall. Do not allow weeds to flower and disperse seed. Deep disking/plowing is not recommended unless the dead plant matter is very thick and will be difficult to plant through.

3. ***Late Summer (August).*** Assess weed pressure.

   - **If adequate weed control is achieved:** Proceed to the Planting Dates section for recommended dates, based on the type(s) of plant material to be used, and a discussion of options. If needed, also plant a cover/nurse crop to provide temporary cover on sites where erosion is a concern and/or where additional weed suppression is needed (see the Cover Crops section).
     - ❖ Use **Option A (dormant seeding)** if site conditions are dry and the ground is not frozen, yet is cold enough to inhibit wildflower germination until next spring.
     - ❖ Use **Option B (spring seeding)** if site conditions are too wet in the fall, or if seeding isn't feasible in the fall for other reasons.
     - ❖ Use **Option C (plugs and container plants, bare-root seedlings)** if more rapid establishment of plantings is desired, especially on small sites.
   - **If weedy vegetation persists:** Repeat site preparation for an additional growing season before planting wildflowers.
     - ❖ ***If adequate weed control is achieved after the second season of site preparation***, follow seeding date recommendations in the Planting Dates section for a fall planting.
     - ❖ If additional time is needed to control weedy vegetation, consider planting a cover crop to suppress weeds and control erosion over winter. The following spring, terminate the cover crop, then resume herbicide treatments or other site preparation methods to control weeds before planting wildflowers.

Solarization and Tarping

***Where to Use*.** Small-scale sites (generally less than ½ acre) that are in full sun. Suitable for conventional or organic strip plantings and small block plantings. Best suited for flat or gently sloping sites in regions with high summer temperatures. Solarization and tarping may also be used on steeper slopes if the slope aspect is favorable (e.g., south-facing slope for maximum sun exposure) and runoff from the impervious plastic surface will not result in erosion.

Solarization and tarping are weed control methods that use plastic sheets to cover the soil and kill existing vegetation prior to planting. Although these methods can control many weed species, they are less effective than using herbicides for perennial weeds with deep roots or rhizomes that can resprout. Plastic that is UV-stable, 4-6 mil thick is recommended for durability and reuse. Note: Solarization and tarping may require more frequent maintenance on sites with high deer pressure. Deer can easily puncture plastic sheets, especially thin plastic.

There are two options:

- **Solarization, using clear plastic sheets** to heat the soil surface to kill growing vegetation and reduce the viability of weed seeds. The process usually takes about 2 to 3 weeks during hot summer months but will take longer during cooler periods. Solarization is most effective in regions where average summer temperatures are high (e.g., Plant Hardiness Zones 7 and 8).
- **Tarping (occultation), using opaque plastic sheets** (black plastic or silage wrap) instead of clear plastic. Because soil temperatures do not rise as high under opaque sheets as under clear plastic, weed seeds are less likely to be adversely affected by the heat, but the lack of sunlight and water under the tarp should be fatal to most mature plants and seedlings. Tarping usually takes at least 4 to 6 weeks to be effective.

Caution. Wet climatic conditions may be prohibitive to equipment access. Adjust the schedule of activities listed below to avoid wet conditions or periods of prolonged drought.

***Additional Information*.** For more information on solarization and tarping, see References section: Hoidal, 2021; Rylander, 2019; Smith, et al., 2017; Xerces Society, 2018.

Instructions

1. ***Late Spring or Early Summer.*** Prepare the site for installation of plastic sheets and a fall dormant planting:

   Mow vegetation and rake off clippings. If needed, especially on highly compacted sites, cultivate lightly (e.g., disk and harrow, or rototill). Time cultivation with dry soil conditions. Deep tillage is not recommended.
   Note: Cultivation later after the plastic is removed is not recommended because it is likely to bring more weed seeds to the surface.

   Ensure that the site is relatively smooth and free of brush or large objects.

   Before installing the plastic, determine how it will be anchored to the soil surface:

   - For **solarization (clear plastic)**, it's best to bury the edges to form a tight seal to hold the heat in. Using hand tools and/or light equipment, dig a narrow trench approximately 4 inches deep around the perimeter of the planting area. This will be backfilled with soil to anchor the plastic.
   - For **tarping (opaque plastic)** or if digging a trench isn't feasible, materials such as lumber (e.g., 2x4s), bricks, sandbags, and landscape staples can be used to hold the edges down. The quantity needed will vary based on the thickness of the tarp and the wind exposure on the site.

   Check soil moisture. If the site is excessively dry, irrigate to a depth of 6-12 inches if feasible before laying plastic. Moist soil enhances weed seed germination and provides better weed control after the plastic is installed. Especially on droughty sites, it may be advantageous to install the plastic in the spring when soils are more likely to be moist.

   Lay out the plastic, pull it taut, and bury the edges in the trench or anchor the edges with other materials as described above. Be careful not to tear the plastic. If needed, weigh down the center of the sheet with a few bricks or rocks.

2. ***Mid- to Late Summer.*** Check plastic at least monthly for rips and tears. Make repairs with greenhouse repair tape or plastic packing tape. Duct tape does not hold well and is not recommended. Regularly mow around the perimeter of the plastic if needed to control weeds. Do not allow weeds to flower and disperse seed.

3. ***Fall.*** Assess conditions under the plastic. Annual weeds are not a significant concern, especially if they haven't set seed. Deep-rooted perennials can be a problem, however.

    - **If adequate weed control is achieved** (and any remaining weeds are mostly annuals): Leave plastic in place until shortly before planting, then remove the plastic. Remove any perennial weeds by using hand tools, being careful to disturb the soil surface as little as possible. Proceed to the Planting Dates section for recommended dates, based on the type(s) of plant material to be used, and a discussion of options. If needed, also plant a cover/nurse crop to provide temporary cover on sites where erosion is a concern and/or where additional weed suppression is needed (see the Cover Crops section).

        - Use **Option A (dormant seeding)** if site conditions are dry and the ground is not frozen, yet is cold enough to inhibit wildflower germination until next spring.
        - Use **Option B (spring seeding)** if site conditions are too wet in the fall, or if seeding isn't feasible in the fall for other reasons.
        - Use **Option C (plugs and container plants, bare-root seedlings)** if more rapid establishment of plantings is desired, especially on small sites.

    - **If weedy vegetation persists** (especially an abundance of aggressive, perennial weeds):

        - Replace the plastic and leave it in place over the winter. Reassess conditions in the spring. ***If adequate weed control is achieved***, follow wildflower seeding date recommendations in the Planting Dates section.
        - If weed control is not satisfactory, reapply the plastic (or use other control methods) for a second growing season and assess conditions again in the fall. Continue site preparation treatments as needed to control weeds before planting wildflowers.

Tillage

***Where to Use*.** Sites with existing cover that needs to be removed by ground-disturbing methods instead of, or in addition to, other site preparation methods. Good option for breaking up dense cover, such as sod, and preparing a seedbed for planting. Best suited for flat or gently sloping sites with low risk for erosion. Applicable for conventional or organic plantings.

Caution. Wet climatic conditions may be prohibitive to equipment access. Adjust the schedule of activities listed below to avoid wet conditions or periods of prolonged drought.

Tillage tends to expose weed seeds and spread live rootstocks, and is usually less effective than herbicides or tarping/solarization for killing heavy sod or persistent weeds. Also, bare ground produced by tillage may be subject to erosion and can provide a seedbed for more weed growth. Avoid using tillage on steep slopes and highly erodible soils.

Instructions

1. ***Spring or Early Summer.*** Begin site preparation for a fall planting:
    - **If existing vegetation is very thick and will be difficult to plant through (e.g., pasture, hay, turf, idle areas)**, use heavy disking/plowing as needed to break up vegetation, followed by light finish disking.
    - **If existing vegetation is not dense,** cultivate with light implements set no deeper than 2 inches.
2. ***Mid- to Late Summer.*** Repeat shallow cultivation (or use another weed control method) each time regrowth reaches 4-6 inches tall. Time cultivation with dry soil conditions. Do not allow weeds to flower and disperse seed. If necessary, plant a cover crop to control erosion and help suppress weeds.
3. ***Fall.*** Assess weed pressure.
    - **If adequate weed control is achieved:** Proceed to the Planting Dates section for recommended dates, based on the type(s) of plant material to be used, and a discussion of options. If needed, also plant a cover/nurse crop to provide temporary cover on sites where erosion is a concern and/or where additional weed suppression is needed (see the Cover Crops section).
        - ❖ Use **Option A (dormant seeding)** if site conditions are dry and the ground is not frozen, yet is cold enough to inhibit wildflower germination until next spring.
        - ❖ Use **Option B (spring seeding)** if site conditions are too wet in the fall, or if seeding isn't feasible in the fall for other reasons.
        - ❖ Use **Option C (plugs and container plants, bare-root seedlings)** if more rapid establishment of plantings is desired, especially on small sites.
    - **If weedy vegetation persists:** Repeat site preparation for an additional growing season before planting wildflowers.
        - ❖ As needed, plant a fall cover crop to suppress weeds and control erosion. The following spring, terminate the cover crop, then resume site preparation treatments to control weeds.
        - ❖ ***If adequate weed control is achieved after the second season of site preparation***, follow seeding date recommendations in the Planting Dates section.
        - ❖ If weed control is not satisfactory, continue site preparation treatments as needed to control weeds before planting wildflowers.

Figure 3.6. Rototilling a vegetated site to break up dense turf. ***Photo: NRCS/R Jay Ugiansky.***

Cover Crops

***Where to Use*.** An annual cover crop can be used as a part of site preparation to provide temporary cover where erosion is a concern and/or where additional weed suppression is needed. A "nurse crop" is a cover crop that is typically planted shortly before or concurrently with a perennial planting. A "smother crop" is a cover crop that is primarily used to suppress weeds during the growing season before a perennial planting occurs in the fall or the following spring.

Cover crops are suitable for conventional or organic sites of any size. Species are available that can be planted during the spring, summer, or fall.

In addition to reducing erosion and suppressing weeds, cover crops help scavenge excess nutrients, build the soil, maintain living roots over winter, and allow time for the soil biota to break down residual pesticides. These benefits make planting a cover crop a worthwhile investment of time and money before planting wildflowers.

***Caution*.** Wet climatic conditions may be prohibitive to equipment access. Adjust the schedule of activities listed below to avoid wet conditions or periods of prolonged drought.

***Additional Information*.** Refer to *Managing Cover Crops Profitably* (SARE, 2012, References section).

Instructions

1. ***Spring, Summer, or Fall.*** Where there is existing competing vegetation, control it by using one or a combination of site preparation methods (e.g., herbicide treatment, solarization/tarping, and/or tillage). As needed, follow up with mowing, and remove heavy residue.

   If the site has no or minimal competing vegetation, proceed with seedbed preparation. Select an appropriate cover/nurse crop based on planting dates and desired plant characteristics. Refer to the Planting Dates section for cover crop and wildflower planting dates. Drill or broadcast the cover crop into a generally clean, smooth, and firm seedbed.

   Suggested cover crops include cool-season species (e.g., oats, barley, wheat, cereal rye) and warm-season species (buckwheat, teff). Teff and oats are generally preferred as cover/nurse crops for fall dormant plantings of wildflowers because the wildflower seed mix can be drilled into the residue or standing stems of the previous crop.

   The instructions below provide information for using oats:

   - **If using oats as a *nurse crop* before a fall dormant seeding of wildflowers**, plant oats at 30-50 lbs/acre, using higher rates for broadcast planting methods and/or later seeding dates (see Planting Methods for more information). Once oats are established, plant the wildflower mix into standing oats.

   - **If using oats as a *winter cover crop* before a spring seeding of wildflowers**, plant oats at 80-125 lbs/acre, using higher rates for broadcast planting methods and/or later seeding dates (see Planting Methods for more information). Most fall-planted oats will completely winter-kill in locations where temperatures are below freezing for long periods. If needed, lightly harrow in the spring to remove oat residue before planting the wildflower mix.

   For information about using buckwheat or teff for a summer cover (or "smother") crop, refer to the Summer Smother Crop (Buckwheat) and Summer Smother Crop (Teff) sections of this guide.

2. ***Late Fall or the Following Spring.*** As needed, terminate the cover crop before it goes to seed (e.g., by mowing) and remove heavy residue. Assess weed control before planting wildflowers:

   - **If adequate weed control is achieved:** Proceed to the Planting Dates section for recommended dates, based on the type(s) of plant material to be used, and a discussion of options.

     - ❖ Use **Option A (dormant seeding)** if site conditions are dry and the ground is not frozen, yet is cold enough to inhibit wildflower germination until next spring.

     - ❖ Use **Option B (spring seeding)** if site conditions are too wet in the fall, or if seeding isn't feasible in the fall for other reasons.

- ❖ Use **Option C (plugs and container plants, bare-root seedlings)** if more rapid establishment of plantings is desired, especially on small sites.

- **If weedy vegetation persists:** Repeat site preparation for an additional growing season before planting wildflowers.

  - ❖ ***If adequate weed control is achieved after the second season of site preparation***, follow seeding date recommendations in the Planting Dates section for a fall planting.

  - ❖ If additional time is needed to control weedy vegetation, consider planting another cover crop to suppress weeds and control erosion over winter. The following spring, terminate the cover crop, then resume site preparation treatments as needed to control weeds before planting wildflowers.

Summer Smother Crop (Buckwheat)

***Where to Use*.** A "smother crop" is a cover crop that is primarily used to suppress weeds during the growing season before a perennial planting occurs in the fall or the following spring. Smother crops produce large amounts of above-ground biomass that grows quickly and can out-compete weeds. Suitable for conventional or organic sites that are accessible to equipment.

Buckwheat is a warm-season, short-lived, broadleaf annual. It produces abundant flowers that are attractive to pollinators, especially bees. Flowering usually occurs within 3-6 weeks. During its growth period, it reaches a height of 2-3 feet and forms a dense canopy. Buckwheat will go to seed about 10-12 weeks after planting. Residue breaks down quickly, so a second planting may be needed in mid-summer, depending on site conditions and when the first crop was planted.

Buckwheat is usually planted in late spring - early summer, but may also be planted as late as the end of July or mid-August (depending on location), provided that sufficient moisture is likely to be available for germination and growth.

Note: Buckwheat is poorly tolerant of drought and high temperatures. It is better suited for planting in Western Maryland than in other regions of the state.

***Caution*.** Wet climatic conditions may be prohibitive to equipment access. Adjust the schedule of activities listed below to avoid wet conditions or periods of prolonged drought.

***Additional Information*.** For more information on smother cropping, refer to *Organic Site Preparation for Wildflower Establishment* (Xerces Society, 2018). For more information on buckwheat, refer to the *Plant Guide for Buckwheat* (USDA-NRCS, 2016) and *Managing Cover Crops Profitably* (SARE, 2012). All of these documents are listed with links in the References section.

Figure 3.7. A dense cover crop of buckwheat can be used to smother weeds can help reduce competing vegetation prior to wildflower seeding. *Photo: Xerces Society/Kelly Gill.*

Figure 3.8. In addition to weed suppression benefits, buckwheat provides a temporary source of abundant flowers attractive to pollinators such as bees and many other beneficial insects. *Photo: Xerces Society/Nancy Lee Adamson.*

Instructions

1. ***Spring*.** Where there is existing competing vegetation, control it by using one or a combination of site preparation methods (e.g., herbicide treatment, solarization/tarping, and/or tillage). As needed, follow up with mowing, and remove heavy residue.

3. ***Late May-Early June.*** If the site has no or minimal competing vegetation, proceed with seedbed preparation. Lightly till (disk and harrow or rototill) to prepare the site for planting. Deep tillage is not recommended. Time cultivation with dry soil conditions. Monitor weather and delay seedbed preparation to avoid extended periods of cool, wet weather.

   On a smooth, firm seedbed, immediately seed the first crop of buckwheat in late spring when soil temperatures are ~65°F. Buckwheat will not tolerate a frost, so the planting date should be well beyond the last spring frost date.

   - **If drill seeding,** use a seeding rate of 50-60 lbs/acre and drill seed at 0.5-1 inch depth in 6-8 inch rows. Adjust seeding rates based on prior site conditions as necessary. If needed, irrigate to ensure buckwheat germination. Reseed any gaps in buckwheat cover crop to prevent weeds from invading.

   - **If broadcast seeding,** increase the seeding rate to 70-80 lbs/acre, lightly scratch seed into soil surface, and cultipack with equipment. Adjust seeding rates as needed based on prior site conditions. If feasible, irrigate to ensure buckwheat germination. Reseed any gaps in the buckwheat cover crop to minimize invasion by weeds.

4. ***Early-Late July.*** Incorporate (disk) buckwheat about 6 weeks after planting (do not disk more than 1 inch deep) and immediately seed a second buckwheat crop. If needed and feasible, irrigate to ensure buckwheat germination.

5. ***Early Fall (~ 6 weeks after second seeding).*** Terminate buckwheat before it goes to seed (mow and remove residue). Assess weed control.

   - **If adequate weed control is achieved:** Proceed to the Planting Dates section for recommended dates, based on the type(s) of plant material to be used, and a discussion of options. If needed, also plant a cover/nurse crop to provide temporary cover on sites where erosion is a concern and/or where additional weed suppression is needed (see the Cover Crops section).

     - ❖ Use **Option A (dormant seeding)** if site conditions are dry and the ground is not frozen, yet is cold enough to inhibit wildflower germination until next spring.

     - ❖ Use **Option B (spring seeding)** if site conditions are too wet in the fall, or if seeding isn't feasible in the fall for other reasons.

     - ❖ Use **Option C (plugs and container plants, bare-root seedlings)** if more rapid establishment of plantings is desired, especially on small sites.

   - **If weedy vegetation persists:** Repeat site preparation for an additional growing season before planting wildflowers.

     - ❖ ***If adequate weed control is achieved after the second season of site preparation***, follow seeding date recommendations in the Planting Dates section for a fall planting.

     - ❖ If additional time is needed to control weedy vegetation, consider planting another cover crop to suppress weeds and control erosion over winter. The following spring, terminate the cover crop, then resume site preparation treatments as needed to control weeds before planting wildflowers.

Summer Smother Crop (Teff)

***Where to Use*.** A "smother crop" is a cover crop that is primarily used to suppress weeds during the growing season before a perennial planting occurs in the fall or the following spring. Smother crops produce large amounts of above-ground biomass that grows quickly and can out-compete weeds. Suitable for conventional or organic sites that are accessible to equipment.

Teff is a warm-season, fine-bladed annual grass that germinates quickly and provides relatively short, dense cover. Once established, teff is tolerant of a wide range of conditions from drought and high temperatures to waterlogged soils. Seeds are very small, so seeding depth is critical and broadcast seeding is recommended. Teff usually grows slowly for the first few weeks, after which growth rates increase until plants reach a height of 12-18 inches. The stand usually self-terminates in late summer, and residue often persists until spring.

Teff is usually planted in late spring - early summer for a smother crop that can provide a full season of summer cover. It may also be planted as late as the end of July or mid-August (depending on location), provided that sufficient moisture is likely to be available for germination and growth.

***Caution*.** Wet climatic conditions may be prohibitive to equipment access. Adjust the schedule of activities listed below to avoid wet conditions.

***Additional Information*.** For more information on smother cropping, refer to *Organic Site Preparation for Wildflower Establishment* (Xerces Society, 2018). For more information on teff, refer to the *Teff Grass Crop Overview and Forage Production Guide* (Miller, 2013). Both documents are listed with links in the References section.

Figure 3.9. Teff provides fine, dense cover. This stand was seeded in late May and was well established by early July when this photo was taken. *Photo: NRCS/R Jay Ugiansky.*

Figure 3.10. Teff tends to lodge (fall over) as plants grow taller. This stand was planted in mid-July and now has 6 weeks of growth. *Photo: NRCS/R Jay Ugiansky.*

Instructions

1. ***Spring*.** Where there is existing competing vegetation, control it by using one or a combination of site preparation methods (e.g., herbicide treatment, solarization/tarping, and/or tillage). As needed, follow up with mowing, and remove heavy residue.
2. ***Late May-Early June.*** If the site has no or minimal competing vegetation, proceed with seedbed preparation. Prepare a seedbed using light tillage (disk and harrow, or rototill and cultipack) as needed. Deep tillage is not recommended. Time cultivation with dry soil conditions. Monitor weather and delay seedbed preparation as needed to avoid extended periods of cool, wet weather.

   Plant teff in late spring when soil temperatures are ~65°F. Teff will not tolerate a frost, so the planting date should be well beyond the last spring frost date. For best weed suppression, it's important to seed teff immediately after seedbed preparation so weeds won't germinate first and get a head start. Teff is most effective for pre-emergent weed control.

Using a broadcast planting method (see Planting Methods for more information), plant teff on a firm, prepared seedbed at a rate of 7 lbs/acre (10 lbs/acre for coated seed). Coated seed is recommended, especially when rotary-spinning teff, because the seed is more visible on the ground. This facilitates a more even distribution of seed. If needed, seeds can be firmed onto the soil surface with a cultipacker or light roller after planting, but do not bury them. Germination is poor when teff is planted too deeply.

3. ***Early Fall (~10 weeks after seeding).*** It is usually unnecessary to terminate teff with herbicide or mowing because teff matures quickly and will self-terminate. Teff residue often persists until spring. Assess weed control.

Figure 3.11. Mature teff at the end of September. *Photo: NRCS/ R Jay Ugiansky.*

Figure 3.12. A dense layer of teff residue from the previous year is providing significant soil coverage the following March. *Photo: NRCS/R Jay Ugiansky.*

- **If adequate weed control is achieved:** Proceed to the Planting Dates section for recommended dates, based on the type(s) of plant material to be used, and a discussion of options. On sites where residue is thin, and erosion is a concern and/or additional weed suppression is needed, plant a cover/nurse crop (see the Cover Crops section).
    - ❖ Use **Option A (dormant seeding)** if site conditions are dry and the ground is not frozen, yet is cold enough to inhibit wildflower germination until next spring. In most cases, the wildflower mix can be dormant-seeded directly into teff residue.

      Mowing the residue is not recommended because it can leave clumps that interfere with seeding. Teff residue will not impede a no-till drill. If residue still very dense in the spring, such that the soil surface is not visible, it may be necessary to mow or rake the residue to release wildflower seedlings.
    - ❖ Use **Option B (spring seeding)** if site conditions are too wet in the fall, or if seeding isn't feasible in the fall for other reasons.
    - ❖ Use **Option C (plugs and container plants, bare-root seedlings)** if more rapid establishment of plantings is desired, especially on small sites.
- **If weedy vegetation persists:** Repeat site preparation for an additional growing season before planting wildflowers.
    - ❖ ***If adequate weed control is achieved after the second season of site preparation***, follow seeding date recommendations in the Planting Dates section for a fall planting.
    - ❖ If additional time is needed to control weedy vegetation, consider planting another cover crop to suppress weeds and control erosion over winter. The following spring, terminate the cover crop, then resume site preparation treatments as needed to control weeds before planting wildflowers.

References

Hoidal, Natalie. 2021. *Using the Sun to Kill Weeds and Prepare Garden Plots*. University of Minnesota Extension. https://extension.umn.edu/planting-and-growing-guides/solarization-occultation

Miller, Don. 2013. *Teff Grass Crop Overview and Forage Production Guide*. Cal/West Seeds. https://kingsagriseeds.com/wp-content/uploads/2013/07/TeffGrassManagementGuide.pdf

Rylander, Haley. January 2019. *Reusable Black Tarps Suppress Weeds and Make Organic Reduced Tillage More Viable*. Cornell University, College of Agricultura and Life Sciences. https://smallfarms.cornell.edu/2019/01/reusable-black-tarps-suppress-weeds-and-make-organic-reduced-tillage-more-viable/

Smith, Grace, Birthisel, Sonja, and Gallant, Eric. June 2017. *Comparing Solarization & Occultation*. University of Maine, Weed Ecology and Management. https://umaine.edu/weedecology/2017/06/01/comparing-solarization-occultation/

Sustainable Agriculture Research and Education (SARE), June 2012. *Managing Cover Crops Profitably*. https://www.sare.org/wp-content/uploads/Managing-Cover-Crops-Profitably.pdf

USDA-Natural Resources Conservation Service (NRCS). 2016. *Plant Guide for Buckwheat (Fagopyrum esculentum)*., Pullman Plant Materials Center. Pullman, WA. https://plants.usda.gov/DocumentLibrary/plantguide/pdf/pg_faes2.pdf

Xerces Society. May 2018. *Organic Site Preparation for Wildflower Establishment.* https://xerces.org/sites/default/files/2018-05/16-027_02_XercesSoc_Organic-Site-Preparation-for-Wildflower-Establishment_web.pdf

This page is intentionally blank.

SECTION 4 - PLANT ESTABLISHMENT

Seeding wildflowers can be a relatively efficient way to establish pollinator habitat. Installing live plants (e.g., plugs and larger containers) usually requires more time and money, but can be used as an alternative to seeding for small plantings. The majority of wildflowers in the Maryland native mixes are perennial species, and much of the initial growth is focused on root establishment. Unlike annual wildflowers, perennials may take a year or more to establish roots and basal leaves before flowering. Some wildflowers may take up to 4 years to become fully established.

Existing weed competition will affect planting success and must be addressed before planting. Because of the relatively long establishment period needed for wildflowers, it is important to reduce competition and prevent shading by weeds in the first two growing seasons. A clean, weed-free seedbed will provide the best chance of success. Where weeds are known to be a problem, a cover crop may be used to control weed growth prior to planting.

Planting Dates

Planting dates in Maryland are based on the Plant Hardiness Zone (PHZ) where the site is located and the types of plant materials to be used.

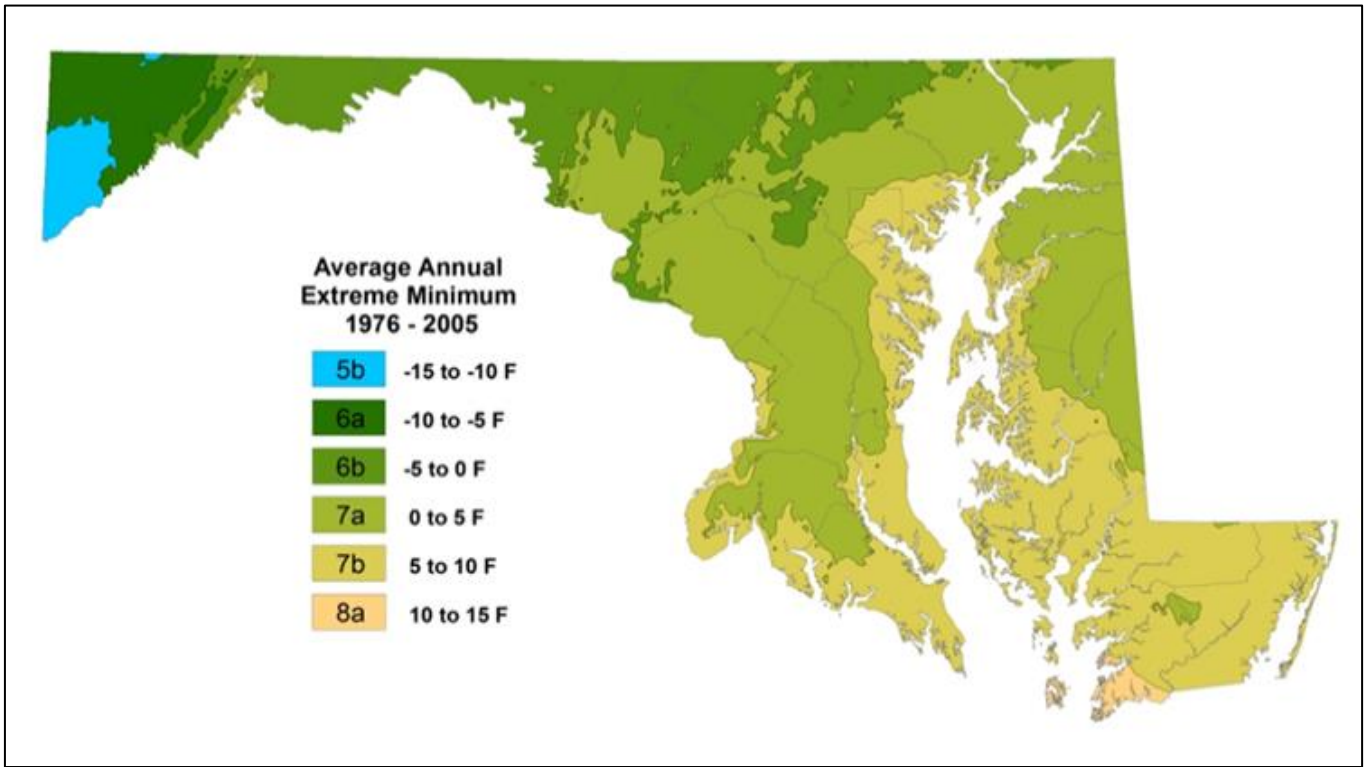

Figure 4.1. USDA Plant Hardiness Zones in Maryland. This map is intended for general guidance. For more specific county-level Plant Hardiness Zone information, refer to local GIS data.

Site conditions, especially soil moisture, influence when a site is suitable for equipment access and planting. Wildflower seed mixes can be planted in a late fall to winter period (dormant seeding), provided the ground isn't frozen or snow covered, or they can be planted in the spring. A small grain (e.g., oats, teff) may be planted as a nurse crop before a fall dormant seeding of wildflowers or as a winter cover crop before a spring seeding. Refer to the Cover Crops section for additional information.

The following options are available for timing of wildflower planting:

- ***Option A. Dormant Seeding.*** Early Nov - Late January, depending on PHZ (see Table 4.1). The objective of dormant seeding is to plant while the ground is not frozen, yet is cold enough to inhibit germination until next spring when soil temperatures warm up sufficiently.

  Site conditions in late fall and early winter may be more favorable for planting than in spring, when soil may be too wet for preparing a seedbed or using drills or other seeding equipment. Seeding in the dormant period allows time to control weeds and reduce competition prior to planting. Cold-moist stratification of seed over winter can enhance wildflower germination.

Dormant seeding needs to occur before the ground freezes hard and there is lasting snowfall. Especially in Western Maryland, the opportunity for dormant seeding may be limited based on local weather conditions.

Refer to Planting Methods for a discussion of planting options.

- ***Option B. Spring Seeding.*** Mid-February through mid-June, depending on PHZ (see Table 4.1) and local weather patterns. Plant when soil moisture conditions are favorable for seedling germination and growth. Caution: Avoid seeding during very wet conditions so as not to compact the soil or cause ruts.

  Spring seeding has some disadvantages: Site conditions for equipment access may be less favorable than in the fall, especially on somewhat poorly and poorly drained soils. Germination may be reduced for some wildflower species (e.g., those that require or benefit from cold stratification). If the wildflower mix is seeded in late spring, it may be more difficult for wildflower seedlings to compete with weeds. Additional weed control may be needed during the first year of wildflower establishment.

  Refer to Planting Methods for a discussion of planting options.

- ***Option C. Plugs and Container Plants, Bare-Root Seedlings.*** Spring and fall dates are available, and vary based on PHZ (see Table 4.1). Soil moisture conditions in the spring may be more favorable for plant establishment than at other times, especially if irrigation during dry periods is not feasible. Plugs and container plants are more expensive to purchase and require more labor than planting seed, but have the advantage of establishing a planting more quickly. Due to the cost of the plants and labor requirements, plugs and containers are best suited for establishing wildflower and/or woody plantings on small sites (e.g., 1 acre or less). Bare-root seedlings are less expensive than plugs or container plants, and are often used for spring planting of dormant trees and shrubs.

  Refer to the Transplanting section for further discussion of this planting method.

The planting dates listed below are averages for each PHZ. These dates may require adjustment to reflect local conditions, especially near the boundaries of the zones.

Table 4.1. Planting Dates.

Type of Planting 1/	Recommended Dates by Plant Hardiness Zones		
	5b and 6a	**6b**	**7a, 7b and 8a**
Wildflower Plantings			
Dormant Seeding (All Mixes)	Nov 1 to Jan 31	Nov 15 to Jan 31	Dec 1 to Jan 31
Spring Seeding - Mix of Wildflowers with WSGs/CSGs	Mar 15 to May 31♦ *Jun 1 to Jun 15**	Mar 1 to May 15♦ *May 16 to Jun 15**	Feb 15 to Apr 30♦ *May 1 to May 31**
Spring Seeding - Mix of Wildflowers with WSGs	May 15 to Jun 15♦ *Jun 15 to Jun 30**	May 1 to Jun 15♦ *Jun 15 to Jun 30**	Apr 15 to May 31♦ *Jun 1 to Jun 30**
Bare-Root Seedlings (Trees and Shrubs)	Mar 15 to May 31 *Jun 1 to Jun 30**	Mar 1 to May 15 *May 16 to Jun 30**	Feb 15 to Apr 30 *May 1 to Jun 30**
Plugs and Container Plants	Mar 15 to May 31 *Jun 1 to Jun 30** *Sep 1 to Nov 15*✦*	Mar 1 to May 15 *May 16 to Jun 30** *Sep 15 to Nov 30*✦*	Feb 15 to Apr 30 *May 1 to Jun 30** *Oct 1 to Dec 15*✦*
Cover Crops			
Barley, Oats, Wheat	Aug 1 to Sep 30	Aug 1 to Oct 15	Aug 15 to Nov 30
Cereal Rye	Aug 1 to Oct 31	Aug 1 to Nov 15	Aug 15 to Dec 15
Buckwheat, Teff	Jun 1 to Jul 31	May 16 to Jul 31	May 1 to Aug 14

TABLE 4.1 NOTES:

1/ Refer to Table 1.2 in the *Maryland Conservation Planting Guide* if other types of plant materials will be used.

♦ In general, seeding during the latter portion of this period allows more time for weed emergence and weed control prior to planting. When selecting a planting date, consider the need for weed control vs. the likelihood of having sufficient moisture for later plantings, especially on droughty sites.

* Additional planting dates during which supplemental watering may be needed to ensure plant establishment.

✦ Frequent freezing and thawing of wet soils may result in frost-heaving of materials planted in late fall, if plants have not sufficiently rooted in place.

Planting Methods

Planting methods need to be site-specific. Consider the availability of seeding equipment during project planning. All seeders require careful calibration to ensure proper rate and spread. Native seed drills are appropriate for sites large enough to accommodate a tractor and drill. Most grain drills are not designed to handle wildflower seeds, which are mostly small and can be fluffy or chaffy. Broadcast seeding and drop spreaders are usually better options for small sites. Transplanting plugs and container plants can also be used for small sites.

Native Seed Drills

Pros:

- Convenient for planting large areas.
- Seed box agitators and depth controls are designed for planting small and fluffy native seeds at optimal rate and depth.
- Seeds are planted in even rows; this makes seedling recognition easier.
- Does not require seed to be rolled or cultipacked after planting.

Cons:

- Specialized drill that may not be readily available.
- Requires a tractor and an experienced operator to set planting controls.
- Difficult to calibrate for small areas (less than 1 acre).
- Seed with a lot of chaff can clog delivery tubes -- requires frequent checking during planting.
- Risk of placing the seed too deep, particularly when seeds of different sizes are mixed together, and when seeding on wet soils.

Instructions

1. Plant only when the soil is dry enough to prevent seed from sticking to the coulters. Under wet conditions, small seed is likely to stick to mud-caked parts of the drill, rather than to the ground. Seedbed should be level to ensure proper planting depth.
2. Keep seed separated by species until ready to plant.
3. Prior to planting, divide seed into batches of large smooth seed, small smooth seed, and tufted seed that does not flow easily.
4. Loosely fill seedboxes with the appropriate seed batch based on size and texture per Step 3. Do not compact seed into boxes. Seed quantities that do not cover the agitator should be planted using some other method, because the drill is difficult to calibrate for small volumes of seed.

Figure 4.2. Native seed drills are ideal for large planting sites (5+ acres). Typical models have depth controls for optimal seed placement and separate seed boxes for different sizes and types of seed. *Photos: Xerces Society/Kelly Gill.*

5. Calibrate the drill. Collect the output from a simulated seeding of a fraction of an acre, weigh the seed, calculate the output in lbs/ac, and compare the amount produced to the desired seeding rate. If the amount is too low or too high, adjust the settings on the drill and repeat the testing process until the desired seeding rate is met.
6. The planting depth for a particular seed should be no more than 1.5x its diameter. To achieve this for most wildflower seed, set the depth controls to plant ***no deeper than ¼ inch***. Consult with the seed vendor for specific guidelines when planting in very sandy soils. Very small wildflower seed should be planted separately on the soil surface.
7. Operate the drill at < 5 mph, stopping periodically to check planting tubes for clogs (usually observed as a seedbox remaining full). Clogging is most common with fluffy seed, or seed with a lot of chaff. Avoid backing up, as it can cause clogging.
8. Stop periodically to check the planting depth. Some seed should be visible on the soil surface.

Hand Broadcasting and Broadcast Seeders

Pros:

- Convenient for planting small areas.
- Inexpensive.
- Easy to use.
- Limits risk of planting seeds too deeply into soil.
- Many models and sizes of broadcast seeders are commonly available (e.g., hand-held crank, and larger tractor or ATV- mounted models).

Cons:

- Requires a smooth, well prepared seed bed.
- Difficult to calibrate seeding rates.
- Some models of broadcast seeders cannot accommodate large seeds.
- Seed needs to be rolled or cultipacked into the soil after planting.

Instructions

1. Prepare a smooth, lightly packed seedbed. Remove stubble and residue from the seedbed prior to seeding. The soil surface can be lightly hand-raked or harrowed to break-up crusted surfaces, but do not cultivate the site after the site preparation phase -- cultivation will bring up additional weed seed.
2. Mix seeds of similar sizes together in separate batches and bulk up seed with an inert carrier such as sand, fine-grained vermiculite, clay-based kitty litter, gypsum, or pelletized lime. Use a 3:1 ratio of inert carrier to seed by volume. Using inert carriers ensures even seed distribution, provides visual feedback on where seed has been thrown, and makes equipment calibration easier.
3. Hand broadcasting:
   - For small sites (e.g., less than 1 acre), seed can be tossed by hand from a bucket or other container.
   - Divide seed into at least two batches, bulk the seed mix with an inert carrier (as described above), and sow each batch separately. Scatter the first batch evenly over the site, then scatter the next batch evenly over the site while walking in a perpendicular direction (i.e., crosshatch pattern) to ensure seed is evenly distributed.
4. Broadcast seeder:
   - Use broadcast seeding equipment that has a flow gate that closes down small enough to provide a slow, steady flow of the smallest wildflower seed. Models with an internal agitator are preferred.
   - With the flow gate closed, fill the hopper with seed. Begin seeding with the flow gate set to the narrowest opening to allow at least two perpendicular passes over the seed bed for even distribution. Very large seed should be seeded separately with the flow gate set to a wider opening.
5. Do not cover the seed with soil after planting. Instead, press the seed into the soil surface using a roller or cultipacker. Water-filled turf grass rollers can be rented at some hardware and equipment rental stores.



Figures 4.3, 4.4, and 4.5. Left: Adding an inert carrier/bulking agent for wildflower seed. Center: Hand-seeding a wildflower mix. *Both photos: Xerces Society/Brianna Borders.* Right: Planting with a hand-crank seeder. *Photo: New Hampshire NRCS.*



Figures 4.6, 4.7, and 4.8. Left: Planting with a tractor-mounted broadcast seeder. ***Photo: Xerces Society/Sara Foltz Jordan.*** **Center: Rolling a seeded area to ensure seed-soil contact. Right: A cultipacker can be used instead of a roller to press seed into the soil.** ***Both photos: Xerces Society/Kelly Gill.***

Drop Seeders and Fertilizer Spreaders

Pros:

- Convenient for planting small or larger areas.
- Inexpensive.
- Easy to use.
- Evenly disperses seeds.
- Limits risk of planting seeds too deeply into soil.
- Many models and sizes available (e.g., hand-powered turf grass seeder/spreaders, larger tractor drawn “pasture-seeders”).

Cons:

- Requires a smooth, well prepared seed bed.
- Calibration requires trial and error to adjust the opening and assess output.
- Hand powered models are time consuming to use on larger areas (e.g., >½ acre).
- Seed needs to be rolled or cultipacked into the soil after planting.

Instructions

1. Prepare a smooth, lightly packed seedbed. Remove stubble and residue from the seedbed prior to seeding. The soil surface can be lightly hand-raked or harrowed to break-up crusted surfaces, but do not cultivate the site after the site preparation phase -- cultivation will bring up additional weed seed.
2. Mix seeds of similar sizes together in separate batches and bulk up seed with an inert carrier such as sand, fine-grained vermiculite, clay-based kitty litter, gypsum, or pelletized lime. Use a 3:1 ratio of inert carrier to seed by volume. Using inert carriers ensures even seed distribution, provides visual feedback on where seed has been thrown, and makes equipment calibration easier.
3. With drop gate closed, fill the hopper with seed. Begin seeding with drop gate set to the narrowest opening to allow at least two perpendicular passes over the seed bed for even distribution. Very large seed should be seeded separately with drop gate set to a wider opening.
4. Do not cover the seed with soil after planting. Instead, press the seed into the soil surface using a roller or cultipacker. Water-filled turf grass rollers can be rented at some hardware and equipment rental stores.

Transplanting

Pros:

- Provides nectar and pollen resources more quickly than by seeding.
- Transplants can compete more effectively on weedy sites than wildflower seedlings.
- Preferred method for plants with limited seed availability that are expensive or difficult to establish from seed.

Cons:

- Plants are more expensive to purchase and require more labor than planting seed.
- May require irrigation during establishment, especially on droughty sites.

Instructions

1. Transplanting can occur any time the ground can be worked outside of frost dates or prolonged periods of hot, dry, or windy weather. Hand spades are adequate for transplanting most container stock. Dibble bars or mechanical transplanters are helpful for planting plugs and bare-root seedlings. Power augers and mechanical tree spades can be used to install larger plants.
2. When designing the layout for the planting, keep in mind that clumps of one species will attract more pollinators than individual plants scattered throughout a habitat area. If interplanting herbaceous wildflowers with shrubs or trees, intersperse the wildflowers in clumps of like species in between the woody plants.
3. Herbaceous weeds and unwanted woody vegetation tend to invade tree and shrub plantings. Controlling weedy growth between trees and shrubs can be time consuming. Consider using a low-growing, herbaceous companion planting (e.g., a red fescue - clover mix) to provide ground cover that will help control weeds and reduce the need for future weed control.
4. Measure the planting area to determine how many plants will be needed based on the sizes of plant materials to be used, expected survival rates, sizes of plants at maturity, and desired density of the planting:

   - **Herbaceous plants:** Mature herbaceous forbs that have a bunch-type growth form need about 6” x 6” of area per plant (= 4 plants/square foot) -- assuming there will be no space between mature plants. Herbaceous plants with a spreading growth habit need about 12” x 12” (or more) for a mature plant.

     For dense plantings (typically for very small areas, such as gardens), use 6-8 plugs per square foot (SF) for forbs with a bunch-type growth form, and 2-4 plugs/SF for spreading species, estimating about 75% survival under natural conditions. With irrigation or a wet site (e.g., rain garden, wetland), the survival rate may be about 95% and the planting rate could be reduced to 4-6 plugs/SF for bunch-type species and 1-2 plugs/SF for spreading species. Larger container plants can be spaced farther apart and planted at 12-18 inches on center.

     For more dispersed plantings in larger areas, plugs can be spaced farther apart (2-3 feet, on center) to reduce the cost of materials and the time needed for planting.

Figure 4.9. Tray of wildflower plugs at a planting site. *Photo: NRCS/R Jay Ugiansky.*

Figure 4.10. Wildflower plugs were planted at the end of May into teff that was seeded at the same time. Wide spacing was used for the wildflowers. Photo shows growth at the end of June. *Photo: NRCS/R Jay Ugiansky.*

- **Shrubs and trees:** Space plants 4-10 feet on center for shrubs and small trees (or more, for large trees), depending on the expected width of the plant at maturity and type of planting stock used (e.g., bare-root seedlings vs. container plants). Consider the type(s) of equipment that will be available for maintenance mowing or trimming, and allow sufficient space between plants for equipment access.

  Survival rates for woody species under natural conditions (no irrigation) are typically estimated at 65% for bare-rooted plants and 95% for container plants.

5. For container plants, it can be helpful to set out the transplants in position with proper spacing prior to installing plants in the ground. Pre-dig and pre-irrigate holes, if feasible. Do not try to "improve" the planting hole by adding sand, peat, compost, or other materials. Existing soil should not be amended unless it contains large amounts of rock, construction debris, or other materials that will adversely affect plant growth. Trees and shrubs planted in natural soil without soil amendments are more likely to develop root systems that extend well beyond the planting hole. If planted in improved soil, roots tend to remain confined in the original hole for a longer period of time.
6. Install plants in holes and backfill with soil as needed. Lightly tamp soil around the plant to increase soil to root contact and minimize the potential for frost heaving (if planted in the fall). Ensure that plants are at proper depth. For bare-root seedlings, the root collar should be 1-2 inches below the soil surface to cover the highest root. Soil at the top of plugs and containers should be flush with the original ground level.

Figure 4.11. Setting out containers before transplanting to achieve proper spacing. ***Photo: NRCS/Tim Dunne.***

Figure 4.12. Installing transplants into pre-dug holes. ***Photo: NRCS/Tim Dunne.***

7. Follow-up irrigation is dependent upon water availability, weather, and specific site conditions. On well-drained loamy soils, new transplants usually need about 1 inch of water per week in the summer and fall, and also during the spring if there is little rainfall. On sandy soils, plants may need up to 2 inches of water per week, preferably in two separate 1-inch waterings. If feasible, irrigate for at least one growing season for herbaceous species and two growing seasons for woody species. Use long, deep watering to encourage root system development. A drip irrigation system that delivers water at the base of plants is preferred. Avoid overhead irrigation that can encourage weed growth. Once plants are established, irrigation can be removed or greatly decreased.
8. During establishment, plants should be protected from damage by wildlife, human activities, or livestock by using plant guards, repellents, fences, and/or other exclusion measures.
9. Mulching is recommended to reduce weed competition and to retain moisture during the establishment phase. Recommended materials include untreated wood chips, weed-free straw, weed mats, or other mulch materials that contain no viable weed seeds. To reduce rodent damage, do not mulch within one foot of seedlings. A nurse crop or cover crop can also serve the purpose of providing temporary surface cover.

This page is intentionally blank.

SECTION 5 - ESTABLISHMENT PERIOD FOR WILDFLOWER PLANTINGS

Weed Control

Wildflower mixes planted from seed are slow to establish. In the first growing season, perennial wildflowers devote most of their energy to root growth and do not grow much above ground. Many species will not bloom until the second or third growing season. Newly planted sites often look patchy or weedy, and the presence of annual or biennial weeds (e.g., foxtail, crabgrass, ragweed, wild mustards) is common, especially during the first growing season. During this time, weeds will grow faster and taller than the slower growing wildflowers. If left unmanaged, weeds can shade out wildflower seedlings, resulting in poor wildflower establishment. As wildflowers mature, plants become more vigorous and are better able to outcompete weeds.

Figure 5.1. Wildflower seedlings can be difficult to distinguish from annual weeds. Among the many seedlings in this photo are ragweed (an annual weed), and three of the seeded wildflowers: tick-trefoil, bee balm, and black-eyed susan. ***Photo: NRCS/Steve Strano.***

Young wildflower and weed seedlings may be difficult to distinguish from each other. Care should be taken to properly identify weeds before treatment.

Frequent **high-mowing,** especially during the first growing season, can be used effectively to prevent weeds from producing and dispersing seed in plantings and adjacent areas. Repeated high-mowing helps control perennial weeds by removing leaves, which reduces photosynthesis and causes the weed to use stored resources to regrow, thus depleting the energy available for production of flowers and seeds. High-mowing requires a mower that can be adjusted to a height of at least 8 inches (e.g., rotary brush mower, flail mower). A lawn mower/finishing mower is not suitable for this purpose.

Additional mechanical methods of weed control include **string trimming** and **hand weeding.** These methods can be used in combination with high-mowing, or as alternatives in small plantings where large mowers aren't needed or practical.

Herbicide treatment may also be appropriate, especially to control noxious weeds and invasive plants. An integrated approach to weed management is often more effective than mowing alone, as some weeds may not be suppressed by mowing and require more effective treatment methods.

Weed control methods need to be site-specific based on the size of the planting, available equipment, weed species, and extent of weed pressure. High-mowing, along with other weed control strategies (e.g., herbicides), is typically used to control weeds. Restrictions on mowing during the nesting season (April 15 - August 15) do not apply during the establishment period for new plantings.

The following guidelines are applicable for most sites:

Planting Year (First Growing Season)

Mow the planting as needed during the summer months to control weeds and keep them from flowering. Mow at a height of 8 to 10 inches, or just above wildflower seedling height, but at a height that will clip off flower buds on the existing weeds. ***Do not let weeds get taller than 18 inches,*** at which point they may shade out the wildflower seedlings. Mowing weeds that have been allowed to put on significant growth may create a mulch that further inhibits wildflower growth.

Do not hesitate to mow because some of the wildflowers are flowering. Typically, most plants flowering in the first growing season are annuals or biennials (e.g., partridge pea, black-eyed susan) that make up a small portion of the mix. Even with mowing, these species will usually flower again. It is far more important to ensure the perennial wildflowers receive enough sunlight and water to support their growth. ***Do not let weeds in the planted area and in adjacent areas produce and disperse seed.*** Mowing should cease by mid-September, unless additional fall mowing is needed to prevent weed seed production and dispersal.

Herbicides can be used to control weeds where application can be targeted in a way that does not kill the wildflowers.

Herbicide application may be useful for treating dense clumps of weeds, or where weeds are significantly taller than the wildflowers. Backpack sprayers are usually preferred for spot-treating small weedy patches. For larger areas, mechanized wick-bar implements can be used when weeds are substantially taller than the wildflower planting.

Do not allow a non-selective herbicide (e.g., glyphosate) to drift or drip onto wildflowers or grasses planted in the mix. Most wildflowers are susceptible to broadleaf control herbicides, so they should not be used in a wildflower planting. Targeted herbicides, such as grass-selective herbicides, can be helpful to control weedy grasses that are common invaders wildflower plantings. If large areas need to be sprayed, reseed or replant any resulting bare patches. Be sure to read and follow herbicide label instructions.

Note: Contact the University of Maryland Extension or local county weed control specialist for site-specific recommendations for controlling weeds. Chemical herbicide treatments must comply with Maryland Pesticide Applicator requirements and be applied in accordance with label instructions.

Figure 5.2. Annual weeds such as foxtail are common invaders in newly seeded wildflower plantings vegetation to expose slower-growing wildflowers to sunlight. *Photo: Xerces Society/ Kelly Gill.*

Figure 5.3. Frequent high-mowing was used during the first growing season to prevent weeds from seeding and to cut back weedy vegetation to expose slower-growing wildflowers to sunlight. *Photos: Xerces Society/Kelly Gill.*

Second and Third Year After Planting

Monitor weed pressure. By the second growing season, wildflowers should be fairly well established. If unwanted grasses or weeds comprise more than 25 percent of the stand, mow the area as necessary (or treat with an appropriate herbicide) to prevent weeds from going to seed. If weeds reach a height of 14 to 18 inches, mow vegetation back to a height of 8 to 10 inches. Cease mowing by late August, unless additional late-season mowing is needed to prevent weed seed production and dispersal. Annual weeds become less of a problem as perennial wildflowers become established and discourage weed seed germination.

Figure 5.4. Site in the first year after seeding is dominated by weeds, especially yellow nutsedge. Weeds were managed with high-mowing and herbicide treatment (rope-wick application). *Photo: Xerces Society/Kelly Gill.*

Figure 5.5. By Year 3 on the same site, a diverse community of wildflowers was established. *Photo: Xerces Society/Kelly Gill.*

SECTION 6 - MAINTENANCE FOR WILDFLOWER PLANTINGS

Wildflower plantings require periodic maintenance to control noxious and invasive weeds, and to prevent succession of woody vegetation. Once the plant community is well established and weed pressure is low, transition to an early successional habitat maintenance plan that encourages wildflower diversity.

If the planting was established with financial assistance, all maintenance activities must comply with applicable program requirements. In general, maintenance should not be conducted during the primary nesting season (April 15 through August 15) or the late summer/early fall pollinator season of activity (through October 31) . Exceptions may be made for periodic mowing, burning, or other treatment during the nesting season if necessary to maintain the health of the plant community.

Control of noxious weeds (specifically, johnsongrass, shattercane, bull thistle, Canada thistle, musk thistle, plumeless thistle, and Palmer amaranth) is required by Maryland state law.

The following sections list some typical maintenance activities:

Weed Control

Control noxious weeds and other invasive or undesirable plants by spot treatment, using mechanical methods or approved herbicides. Hand-weeding can be used for controlling weeds in small areas. If it becomes necessary to control noxious weeds during the nesting season, contact the local weed control specialist for recommendations.

Control of Woody Growth

Methods to control woody growth in wildflower plantings include mowing (i.e., bush-hogging), targeted herbicide treatment, and prescribed burning. Mowing is the most common method because of access to equipment. Herbicide treatment is a common and effective method of controlling brush, but care must be taken not to kill the wildflowers. Prescribed burning is probably the best method for controlling woody vegetation in a wildflower planting but is not always a viable alternative because of issues with permits and availability of trained fire crew.

Mowing. Mow as needed, but preferably on a 2-to-3-year rotation, mowing only 1/3 to 1/2 of the planting each year. The remaining unmowed areas will provide year-round wildlife food and cover. Do not mow for cosmetic purposes.

Generally, mowing should not be conducted during the primary nesting season (PNS) of April 15 through August 15. Mowing should also be avoided in late summer/early fall (through October 31) because of the high level of pollinator activity that occurs at this time.October 31.

However, mowing in late summer or early fall, prior to leaves turning color, is the most effective time to controlling woody growth because it limits the amount of carbohydrate reserves that can be translocated to the roots. When client objectives or program requirements limit mowing to the dormant season, woody vegetation can be controlled by spot treatment with herbicides.

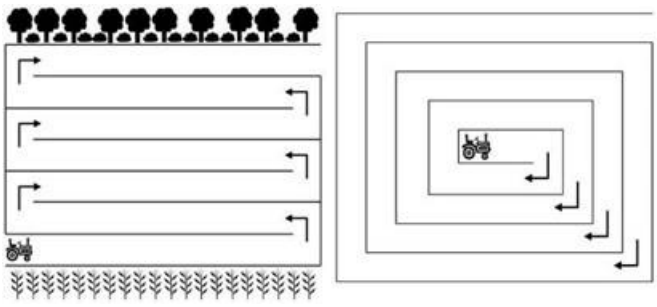

Figure 6.1. Edge-to-edge (left) or inside-to-outside (right) mowing patterns provide escape routes for wildlife.

Spot mowing during the PNS can be used to control weeds or provide resources for targeted species. During this time, mowing should be limited to specific areas, and should not exceed more than 1/3 of the stand. If the area is enrolled in a financial assistance program, mowing and management during the PNS may not be allowed.

To the extent possible, mow in a manner that will provide escape routes for wildlife at the time of mowing, such as mowing from the inside out, or mowing from the field side toward the woods edge.

Targeted Herbicide Application. Herbicide treatment is a common and effective method for controlling woody vegetation. However, because wildflowers are susceptible to most herbicides that control broadleaf plants, the use of herbicides in wildflower plantings should only be used in a targeted manner that limits wildflower exposure to the herbicide.

Methods vary depending on the type, size, and age of the target species, and the size of the treatment area. This

guide provides some general recommendations on the use of herbicides for woody vegetation control. For more specific information, contact the University of Maryland Extension or county weed control specialist.

Small areas of woody vegetation can be treated using basal bark, foliar spray, or cut-surface treatment methods in which the herbicide is applied with portable sprayers and hand tools.

Large areas of woody vegetation will likely require foliar application of a systemic herbicide using a wick-bar applicator. Systemic herbicides (e.g., 2,4-D) are absorbed by the plant and translocated to the roots. Woody vegetation may need to be mowed and allowed to re-grow to enable effective application of herbicide to foliar surfaces.

Application of systemic herbicides in late summer or early fall, prior to leaf drop, is typically more effective because the herbicide will be translocated to the roots. Check the pesticide label to determine the types of plants that are controlled or damaged by the herbicide. Always read and follow the pesticide label when applying herbicides.

Protect Plantings from Pesticides and Other Damage

As needed, clearly mark plantings with posts, flags, or other methods to designate the area as protected wildlife habitat and minimize damage from farming operations, vehicle traffic, and other human activities.

Insecticides, including some insecticides approved for organic farms, can kill or have sub-lethal effects on pollinators and beneficial insects. Some fungicides and herbicides also show toxicity against insects. Herbicide drift or over-spray from adjacent areas can damage or degrade the wildflower plant community. Avoid direct application of pesticides, drift from adjacent areas, or other routes of exposure. If pesticides will be applied in adjacent areas, use set-backs and implement Integrated Pest Management (IPM) techniques to minimize pesticide use and reduce drift. Apply pesticides toward dusk when pollinators are less active, and choose pesticides that are less toxic to bees and other beneficial insects.

Herbivore damage by wildlife (e.g., deer, rabbits, rodents) can be especially significant when transplants are used. These plantings are usually much less dense than seeded plantings, and cannot sustain much damage until plants are well established. Herbivore damage may be reduced by using protective tubes, cages, fencing, or other exclusion devices around plants. Remove materials that could impede plant growth as soon as possible after plants are established.

SECTION 7 - MANAGEMENT FOR WILDLFOWER PLANTINGS

The primary management objective of a native wildflower planting is to maintain the wildflower component of the stand. After establishment, the main threats to wildflowers in the stand are competition from perennial grasses and encroachment of woody vegetation. Prescribed burning, strip disking, strip herbicide application, and interseeding native forbs and legumes may be used alone or in combination to control undesirable grasses and woody vegetation, and maintain the wildflower component of the planting.

The best time to implement management activities on wildflower stands is in early fall, when wildflower germination and development is encouraged, and control of perennial warm-season grasses and woody vegetation is most effective.

Generally, management practices should be conducted outside of the primary nesting season (PNS) to provide sufficient time for birds and ground-nesting wildlife to fledge. Management practices should also be avoided during the late summer/early fall (through October 31) when wildflowers are blooming and pollinator activity is high. In some cases, however, specific management activities may be conducted during the PNS or late pollinator activity season to provide resources for targeted species. During this time, mowing should be limited to specific areas, and should not exceed more than 1/3 of the stand. If the stand is enrolled in a financial assistance program, management during the PNS may not be allowed.

Management activities are conducted on an as-needed basis to achieve desired objectives. Management activities on perennial wildflower stands are implemented less frequently than on annual wildflower stands. Management on perennial stands is usually not conducted until at least 5 years after planting, while annual wildflower stands are usually disked on a 2 to 3-year rotation.

Prescribed Burning

Prescribed burning is the most effective management technique for removing accumulated plant litter and controlling woody plants. Prescribed burning will also enhance wildflower and warm-season grass re-growth by exposing seed to sunlight and releasing nutrients that are bound up in plant litter.

The best time to conduct prescribed burning on wildflower stands is early fall. Burning at this time is most effective for controlling woody vegetation. Winter burns may encourage wildflowers but are less effective at controlling woody vegetation. Spring burns favor warm-season grasses and harm wildflowers. Do not burn during the primary nesting season (April 15 - August 15).

Conduct prescribed burning on a 3-to-5-year rotation, or as needed to control woody growth. Burn only 1/3 to 1/2 of the wildflower stand at a time to maintain food and cover for wildlife.

The photos that follow depict a prescribed burn conducted on a large planting on Maryland's Eastern Shore.

Figure 7.1. Conducting a prescribed burn in April on a mixed stand of native grasses and wildflowers. Note the bare ground firebreak in the foreground. ***Photo: NRCS/Daniel Lawson.***

Figure 7.2. This stand was 6 years old. The burn was conducted primarily to control invading woody growth, especially red maple and sweetgum saplings. ***Photo: NRCS/Daniel Lawson.***

Figure 7.3. This part of the field adjacent to the woods had significant amounts of red maple and sweetgum that needed to be controlled. *Photo: NRCS/Daniel Lawson.*

Figure 7.4. Late June -- two months after burning. Wildflowers (milkweed and spiderwort) are beginning to bloom. *Photo: NRCS/Steve Strano*.

Prescribed burning requires the use of firebreaks that are usually 12 to 15 feet wide. Existing strips of cool-season grasses or disked strips of bare ground can be used as firebreaks.

Prescribed burning can facilitate disking, which can be used to promote the germination of wildflower seeds. However, disking can also promote the germination of weed seeds. If wildflowers do not return in the numbers expected after burning, try lightly disking 30-foot strips to promote germination.

Prescribed burning requires a permit and may not be allowed in some areas. Contact the local office of the Maryland Department of Natural Resources -- Forest Service for information concerning permits and assistance for this practice. In addition, a prescribed burn plan, written by a qualified individual in accordance with the Maryland conservation practice standard for Prescribed Burning (338), is necessary and must be followed.

Strip Disking

Strip disking can be used to increase the vegetative diversity in a stand. However, disking should only be conducted in wildflower stands when the need exists. Disking is not necessarily needed in a diverse stand of wildflowers with a minor component of perennial grasses. Many wildflowers used in mixes are perennial, and some may not fully develop for three to four years after seeding. Disking during the development period may destroy seedlings. If perennial wildflowers were planted, wait at least 5 years before disking.

If a stand does become dominated by perennial grasses, disking may be used to simultaneously reduce the amount of perennial grass cover and promote wildflower germination. The appropriate intensity and timing for disking will depend on the purpose of the planting and the stand characteristics. Disking should only be used if it will not result in excessive erosion or adversely impact water quality, and will not destroy the planting.

Minimum Set-backs. For water quality purposes, avoid disking within 20 feet of a watercourse, water body, or wetland, or within 15 feet of intensively used areas (e.g., barnyards, conventionally tilled land).

Disking Intensity. Before disking, mow the area that will be disked. Fall mowing can facilitate spring disking by providing time for breakdown of leaf matter.

The required disking intensity will vary depending on the stand condition. For stands where perennial grasses are not dense, a single pass with a light finish disk may be sufficient to set back grasses and encourage wildflower germination.

Thick stands of perennial warm-season grasses will require heavier, more intensive disking to open up the stand. In thick stands, multiple passes with a tandem disk or a single pass with a heavy offset disk may be required to thin the grasses. A heavy offset disk will slice and turn the soil and bury residue, which may be needed to reduce the overall cover of grasses. After use of a heavy offset disk or when the soil has been turned over, the soil surface should be smoothed with a cultipacker, harrow, or other finishing implement.

Spacing and Timing. Disk in strips on 1/3 to 1/2 of each field as necessary to maintain vegetative diversity. Disk on the contour in an alternating pattern of disked and undisked strips. Do not disk perennial wildflowers in the first 5

years after planting. Annual wildflowers may be disked more often, usually on a 2 to 3 year rotation.

The best time to disk to promote wildflower germination is in late summer to early fall (September 1 to October 15). Late summer/early fall disking may also be more effective for reducing the density of warm-season grasses, because at this time they are sending reserves into their roots. If fall disking is not possible, disking can be conducted in late winter to early spring (preferably in March), although this is likely to encourage the growth of annual grasses (e.g., foxtail). Do not disk during the PNS.

After disking, monitor the site for weeds and apply control methods if necessary.

Use the following additional guidance for disking on highly erodible land with an Erodibility Index (EI) ≥ 16:

- Disk in strips no wider than 30 feet. Undisked strips should be twice the width of disked strips. Disking intensity should be light enough to maintain at least 30% residue cover in the disked strips. Do not disk parts of the field where excessive erosion is likely to occur.
- On highly erodible land with an EI > 30, only disk in the upper half of the slope, and adjust the disking intensity to attain at least 60% residue cover.

Strip Herbicide Treatment

On grass and wildflower stands that have become dominated by grasses, herbicide treatment may be used to restore the wildflower component of the stand. Native wildflower seeds may reside in the soil for many years without germinating if they are completely shaded out by grasses and other vegetation. Thinning of the grass stand can provide the light needed to prompt germination of existing wildflower seeds.

The purpose of chemical suppression spraying is not to completely eradicate the grasses, but to reduce their vigor and abundance to encourage wildflower diversity. The goal of the herbicide application should be to suppress approximately 50% of the perennial grasses within the treatment area.

Spraying should be done in strips or blocks, and applied to only 1/3 (preferred) to 1/2 of the field in any one year. Target areas where grasses dominate to minimize damage to desirable forbs and legumes.

Figure 7.5. A dense stand of native grasses was sprayed in strips with glyphosate. The openings created by the herbicide treatment prompted the germination and growth of wildflower seeds that were waiting for a disturbance. *Photo: NRCS/Steve Strano.*

To be effective, herbicides must be applied when the grasses to be suppressed are actively growing. The best time to apply strip herbicide treatment on stands containing warm-season grasses is in late summer and early fall, when wildflower germination and development is encouraged, and control of perennial warm-season grasses is most effective.

Check the pesticide label to determine the types of plants that are controlled by the herbicide, and follow the pesticide label when applying herbicides. Consult with the University of Maryland Extension or county weed control specialist for specific herbicide recommendations.

Interseeding Native Forbs and Legumes

The native wildflower component of a stand of herbaceous vegetation tends to naturally decline with age, and the stand tends to become dominated by perennial grasses. Wildflowers may be interseeded into existing herbaceous vegetation to maintain plant diversity and provide food for wildlife.

Select a seed mix with wildflowers that germinate and establish relatively quickly. In the Maryland Conservation Planting Guide, Section 2, Mix 8d – the *High Diversity Native Wildflower and Legume Mix for Interseeding* – is recommended for this purpose. This mix has a higher proportion of fast growing annual and perennial wildflowers than the other Maryland wildflower mixes.

Spring is the best time for interseeding this mix because of its high percentage of annual wildflowers. A late fall dormant seeding can also be used, and will provide better timing with fall disking that encourages germination of

forbs and legumes existing in the seedbank. Use appropriate planting dates based on the Plant Hardiness Zone of the site.

Site Preparation. If the grass stand is thick or contains more than ¼-inch of litter (thatch), lightly disk or harrow the stand prior to seeding. For very dense and vigorous grass stands, targeted herbicide application can be used to kill some of the grasses and create space for wildflower development (see the previous section on strip herbicide treatment). It is important to ensure that the stand contains space for wildflowers to establish. When disking or harrowing is needed, use a minimum set-back of at least 20 feet from a watercourse, water body, or wetland.

Planting Methods. Wildflowers may be interseeded by broadcast or no-till drill methods. For either method, the grass needs to be cut short prior to seeding. For broadcast seeding, mix the wildflower seed with a bulking agent/carrier such as pelletized lime, sawdust or cat litter so the seed will be more evenly dispersed. Broadcast the seed. Then go over it with a cultipacker, drag, or harrow to enhance seed-to-soil contact. When seeding with a no-till drill, set the drill to place seed about ¼-inch into the soil. Avoid placing the seed too deeply into the soil as this can inhibit germination.